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ABSTRACT

The microcomputer and microcomputer systems are viewed as offering a wealth of new opportunities for school mathematics programs, and provide an alternative to time-sharing in both cost and convenience. Four possible sources of suitable software are noted, and the following types of programs are discussed as useful for classroom work: (1) drill and practice, (2) tutorials, (3) demonstrations, (4) computer managed instruction, (5) problem solving, and (6) simulations. It is concluded that microcomputers offer inexpensive delivery systems for teacher-prepared courseware, but are not intended to preempt the use of more classical mediums such as print. This technology is seen to offer both teachers and students new opportunities to expand interest and knowledge. (MP)

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# APPLICATIONS OF THE MICROCOMPUTER TO EXISTING MATHEMATICS COURSES

by

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The microcomputer and microcomputer systems are offering a wealth of new opportunities for school mathematics programs even though some schools have had computer time available to their instructional programs for the past twenty years.[1] In fact, the computer has been used at all levels of education in the United States. Until recent times, the typical school with computer time available would have been the larger metropolitan schools. The delivery system for this computer time would most often have been either time-sharing, using a few remote terminals, or a system of batch processing. Among the disadvantages in the case of terminals have been the cost of equipment and the small amount of contact time per student, and in the case of batch processing, the amount of turn-around time. The recent developments in microcomputer technology have made inroads into solving some of these problems.

The microcomputer has provided an alternative to time-sharing in both cost and convenience. A microcomputer will generally sell for less than the cost of a terminal that can be tied to a large computer system. In addition the user would also have the cost of computer time when using the terminal. This means the school may maintain a lower student/machine ratio with the microcomputers. The peripheral equipment for the microcomputer usually includes a cassette drive, or disc drive, and possibly a printer. The convenience of having the microsystem's full attention without interruptions for time-sharing is also an advantage. The number of memory locations is less with the microcomputer but most of them are 16K or larger and will work quite well for instruction. The cost and

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convenience factors together with the development of BASIC[2] and other interactive languages have made computer time available for instructional programs in schools of all sizes and descriptions. Some of the smaller schools offer more hands-on time with the machine because of a lower student/machine ratio. Another advantage to the relatively low cost has been that microcomputers are now bought and devoted solely to instruction. Often times, larger systems had to be shared between instructional and administrative uses to justify the expense.

In order to take full advantage of the opportunities available when computer time is accessible for instruction a teacher should become familiar with a computer language and with the capabilities of the hardware. Many of the microsystems are equipped with a BASIC interpreter since BASIC is particularly adapted for use on the small computers. Each brand of microcomputer will have its own distinctive features, but the most popular ones are similar enough that converting from one system to another is not terribly difficult. A teacher must also decide how they are going to use the computers. This usually entails developing software or courseware suitable for the specific classroom objectives.

The problem of obtaining suitable software is similar regardless of the level of instruction. The available sources are (1) commercial, (2) teacher written, (3) corporate-sharing, and (4) student written. Although there are good commercial programs available, most schools find themselves in the position of having to decide between buying software or purchasing more equipment. Also, the problem of purchasing software to use in the classroom is similar to selecting a textbook. Many programs have some nice features but it is difficult to find one program that contains all the features that are desired. Teacher written materials are usually more

acceptable from the standpoint of compatibility although the teacher must have quality time in which to write. A source becoming more popular is a type of program swapping group where teachers essentially "trade" programs. Of course, the students themselves are eventually capable of producing some nice work.

The computer uses for the classroom are varied. Some suggested types of programs are:

(1) Drill and Practice; (2) Tutorials; (3) Demonstrations; (4) Computer Managed Instruction; (5) Problem Solving; and (6) Simulations. This is not to imply that everything that the student does on the computer should be pre-written by the teacher. These are simply some suggested areas in which you might prepare some software or courseware.

Drill and Practice. These programs are the most used educational software in mathematics and science. There are a number of enhancements that a teacher might add to the standard set of exercises by using the computer. The teacher may wish to add a timing function to time students out of a set or control the rate of presentation of a set of problems. A choice of difficulty levels could also be given with an option to automatically terminate after a variable number of problems if the work has been extremely difficult or easy. The exercise set may be personalized with random praise or suggestions for improvement. Graphics or animation may be added for motivation. The student could be given immediate feedback with possibilities of a second chance. The teacher could store summary information from the student's work to include number of attempts and number correct.

The Drill and Practice program is the most difficult to write in terms of defensive programming. The user must interact with the program

without causing the system to crash. BASIC language has some nice string handling capabilities which are helpful with this problem.

Tutorial. Tutorial programs may be written in such a way that the user is taken through a concept in a logical manner. Many of the enhancements mentioned with Drill and Practice programs may also be used with Tutorial programs. In addition, the student may be allowed to control paging to adjust for reading rate. Check responses may be included at key points to make sure the student is understanding and branching options can be made available.

Demonstration. Demonstration programs may be used to illustrate a concept that would not ordinarily be included in the course. For example, many texts show the method of determinants to solve two equations in two unknowns but a demonstration could be used to show the outlined solution of larger systems. Demonstrations are similar to tutorials, except the objectives would be for enrichment purposes.

Computer Managed Instruction. The mathematic curriculum in most schools may be enhanced by using the computer to aid in storing and retrieving data relative to the objectives of the program. Because of the speed in analyzing the data, the school could keep an accurate accounting of the individual progress of a large number of students and could individually prescribe any remedial work or enrichment activity without taking away from the teachers actual instruction time.

Problem Solving. This is an area where the student could participate to a much fuller extent in the programming of solutions to problems. A student would have to develop analytical and problem solving skills to be able to program solutions on the computer.

Simulations. Because of the size and detail needed in such programs,

most of these are commercially produced at present.

In conclusion, the microcomputer offers an inexpensive delivery system for teacher prepared courseware, but it is not intended to pre-empt the use of more classical mediums, namely print. It does afford both the teacher and student an opportunity to expand their knowledge and interest.

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